TELTONE®

M-904
Precise Dial Tone Generator

M-904 Precise Dial Tone Generator

Contents

Page

1. GENERAL 2
2. THEORY OF OPERATION 2
3. ORDERING INFORMATION 3
4. INSTALLATION AND TESTING 3
5. TROUBLESHOOTING THE M-904 7
6. MAINTENANCE 8
   (A) Maintenance exercise 8
7. SPECIFICATIONS 8

REVISIONS 11

FIGURES

1 M-904 PRECISE DIAL TONE GENERATOR 1
2 M-904 BLOCK DIAGRAM 2
3 23-INCH MOUNTING ADAPTER 3
4 WIRE WRAP CONNECTIONS 4
5 S2 AND S3 OPTION SWITCHES 6

TABLES

1 BASIC UNITS 3
2 SEPARATE COMPONENTS 3
3 OUTPUT CONNECTIONS 5
4 TROUBLESHOOTING THE M-904 6

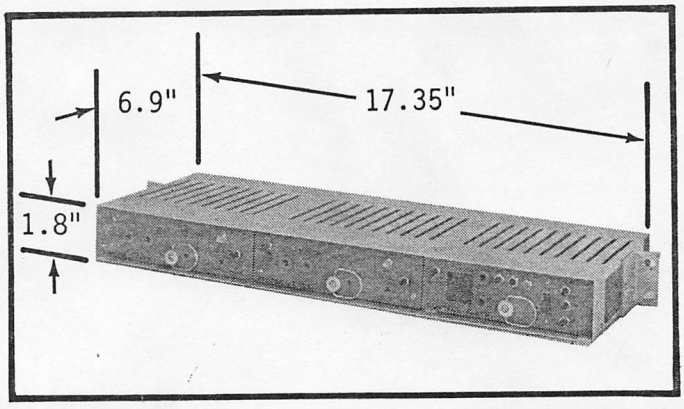


FIGURE 1 M-904 PRECISE DIAL TONE GENERATOR

® TELTONE is a registered trademark of TEL-TONE CORPORATION
Copyright © 1977 by TEL-TONE CORPORATION
Printed in U.S.A.

1. General

1.01 The M-904 is a precise Dial Tone Generator unit for central office or PBX applications. The unit provides selectable dial tone of either 350 Hz, 440 Hz or both at up to one watt output and low harmonic distortion. The M-904 consists of two identical Dial Tone Generator circuit cards and a Control/Alarm circuit card. If the frequency tolerance or output level fails or the quality becomes degraded from either Dial Tone Generator, an alarm (graded major or minor depending on the failure) will be initiated. The alarm contacts are dry relay contact closures. If the source connected to the output fails, it will be disconnected and the redundant dial tone source will be automatically connected to the output terminals. The M-904 features include fuse alarms, front panel adjustments, output test jacks, operational status lamps, power-on-reset, manual fail test circuits and protected wire wrap terminals.

2. Theory of Operation

2.01 There are two dial tone generators which contain the 350 and 440 Hz oscillators that feed their respective detector circuits. The detector circuits provide a signal to the fault detector circuits, if any oscillator frequency drifts more than 1.5 percent. The oscillators also feed the preamplifier circuit, which also mixes the 350 and 440 Hz tones to produce the dial tone. Switches are provided on the circuit cards to select either or both tones. The preamplifier feeds the power amplifier circuit. The power amplifier output is fed to the tone control circuit on the Control/Alarm circuit card. At this point, a sample of the dial tone is fed back to the level detector in the Dial Tone Generator circuit card. The level detector is set by the user as described in Section 4, INSTALLATION AND TESTING, by a simple front panel adjustment. If the tone output from the power amplifier should vary by more than 3 ± 0.5 dB from

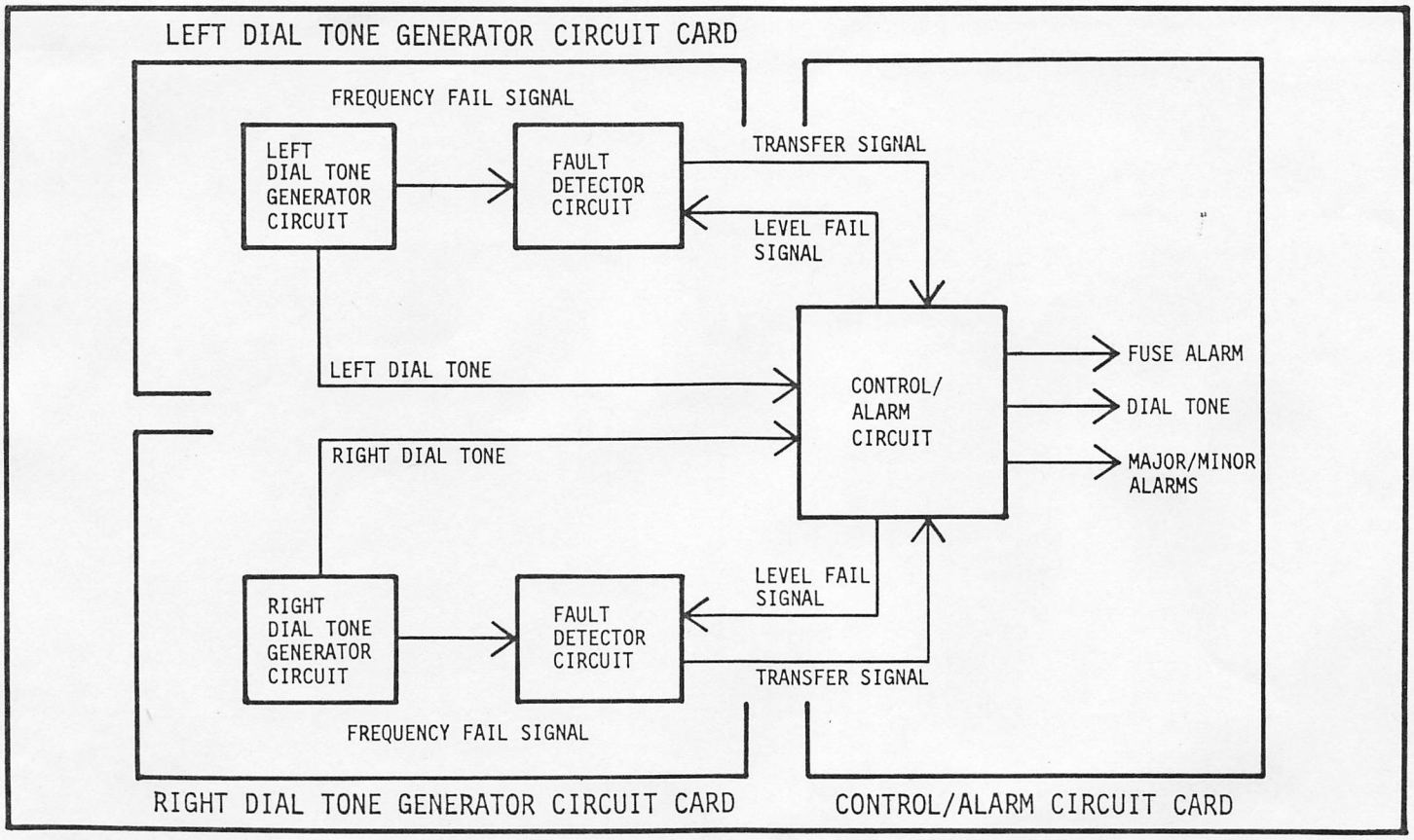


FIGURE 2 M-904 BLOCK DIAGRAM

the set level, the level detector will send a signal to the fault detector circuit. The fault detector operates in about 220 milliseconds, thus eliminating false failure alarms due to momentary short term transients or power disruptions. The output of the fault detector drives the alarm control circuit in the Control/Alarm circuit card.

2.02 The alarm control circuit is composed of two latching relays. The relays provide alarm outputs and also commands the tone control circuit. A relay in the tone control circuit controls which tone source, left or right, will be connected to the output terminals. The relay also has a contact pair providing a ground return path to the IN USE lamp on the Dial Tone Generator circuit card. The tone control circuit includes a multi-tap transformer. This allows the customer to select and adjust the output voltage from 0.5 to 23 VRMS for dual frequency or from 0.35 to 16 VRMS for single frequency. The level control (preamplifier) on the Dial Tone Generator provides the variable adjustment between the tap levels. Each circuit card is fused separately and the fuse alarm circuit is independant of the graded alarms. The -48 VDC input power is applied to the wire wrap pins as shown in figure 4. Two -48 VDC power sources are applied to the -15 VDC power supply regulators, located on each Dial Tone Generator circuit card. The -15 VDC supplies the circuits on its respective card. The relays on the Control/Alarm card are powered by a fused -48 VDC source. A minor alarm is initiated if one of the Dial Tone Generator cards fail or a -48 VDC fuse fails supplying a particular Dial Tone Generator circuit card. A major alarm is initiated if both Dial Tone Generator circuit cards fail or the -48 VDC fuse fails supplying the Control/Alarm circuit card. If the left Dial Tone Generator is removed, the "card on line" ground loop will be opened and signal the alarm control and tone control circuits to transfer the tone output from the left source to the right source automatically and initiate a minor alarm. The audible alarms (major and minor) may be disabled by a front slide switch on the Control/Alarm circuit card. This is accomplished by the ACO (alarm cut-off) switch. When the switch is ON, the ACO lamp will light, indicating that the audible major and minor alarms are disabled. The ACO switch does not disable the visual alarm outputs.

3. Ordering Information

3.01 Order basic units from table 1 and separate components from table 2.

ORDER NUMBER	MOUNTING 19-INCH	MOUNTING 23-INCH
M-904-01	X	
M-904-02		X

TABLE 1 BASIC UNITS

PART NUMBER	DESCRIPTION
201-00256-01	DIAL TONE GENERATOR CIRCUIT CARD
201-00257-01	CONTROL/ALARM CIRCUIT CARD
115-00019-01	HOUSING
101-00023-01	23-INCH MOUNTING ADAPTER

TABLE 2 SEPARATE COMPONENTS

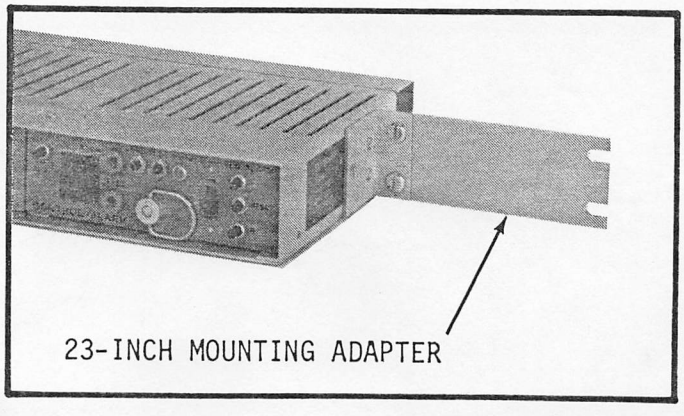


FIGURE 3 23-INCH MOUNTING ADAPTER

4. Installation and Testing

4.01 Remove the M-904 from the shipping container. Remove all the circuit cards from the housing. Verify that the items received agree with the shipping invoice.

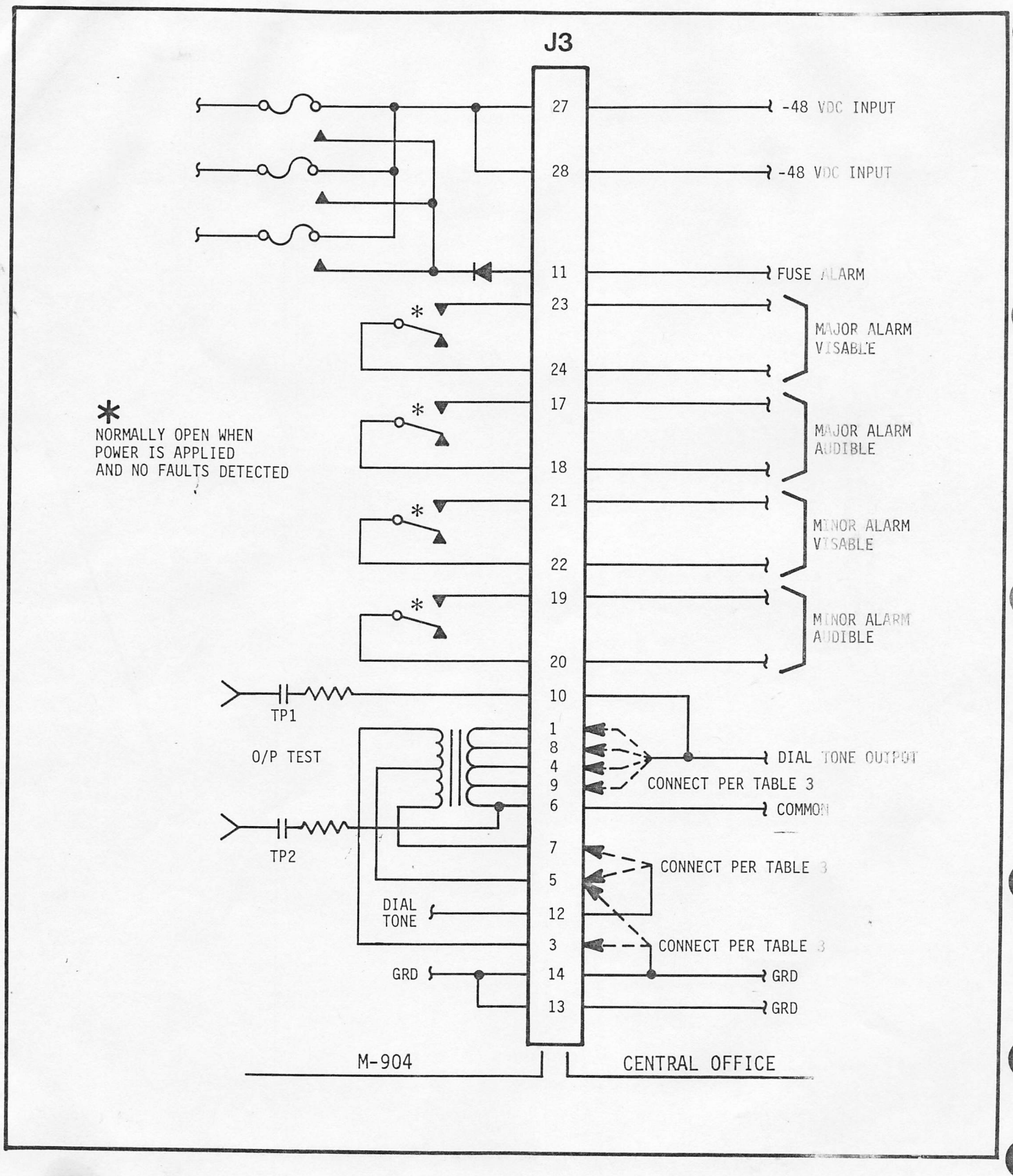


FIGURE 4 WIRE WRAP CONNECTIONS

VOLTAGE REQUIRED DUAL FREQUENCY VRMS AS MEASURED WITH AN AVERAGING VOLTMETER	VOLTAGE REQUIRED SINGLE FREQUENCY VRMS AS MEASURED WITH AN AVERAGING VOLTMETER	TRANSFORMER INPUT GRD CONNECT PIN 14 TO	TRANSFORMER INPUT CONNECT PIN 12 TO	TEST POINT ON PANEL CONNECT PIN 10 TO	USE OUTPUT PINS ON CARD (PIN 6 COMMON)
---	0.35 TO 0.6	3	7	9	9
0.5 TO 0.72	0.6 TO 1.1	3	5	9	9
0.72 TO 1.4	1.1 TO 2.1	3	7	4	4
1.4 TO 2.4	2.1 TO 3.7	3	5	4	4
2.4 TO 4.3	3.7 TO 6.6	3	7	8	8
4.3 TO 6.5	6.6 TO 10.0	3	5	8	8
6.5 TO 8.5	10.0 TO 13.0	3	7	1	1
8.5 TO 16.0	13.0 TO 16.0	3	5	1	1
16.0 TO 23.0	---	5	7	1	1

TABLE 3 OUTPUT CONNECTIONS

Inspect the material to assure that no shipping damage has occurred.

4.02 Install the housing in the desired location, using four screws, onto the relay rack. The M-904 requires at least two-inches of vertical space. Do not install the circuit cards at this time. Remove the back cover by using a ¼-inch flat blade screw driver, exposing the back wire wrap pins. The connector J3 (refer to figure 4) is located on the left as viewed from the back of M-904. The connector has a double row of wire wrap pins, while the other connectors J1 and J2 have single rows of wire wrap pins. J1 and J2 are prewired and no connections should be made to these connectors. All wiring should be on J3 as shown in figure 4. Number 20 gauge wire is recommended for all wiring. Wire the -48 volt and ground leads. Connect the alarm outputs to the office alarm station. Do not connect the M-904 dial tone output to the office or pins numbered 10, 1, 8, 4, 9, 6, 7, 5, 12, or 3 at this time.

4.03 Measure the output level of the present dial tone generator in use. Record the level in terms of volts RMS for a reference. Refer to table 3. Connect the jumpers as determined by table 3 to obtain the same output from the M-904 as the reference level. The table assumes that the OUTPUT LEVEL potentiometer on each Dial Tone Generator circuit card is set to mid-range.

4.04 Refer to figure 5. Set the option switches S2 and S3 on each Dial Tone Generator card to ON for both 350 and 440 Hz dial tone. If a 350 Hz dial tone is required, set S2 to ON and S3 to OFF. If a 440 Hz dial tone is required, set S2 to OFF and S3 to ON.

CAUTION: Care should be observed when inserting the circuit card into the housing. Be sure that the circuit cards are mating with the card guides to prevent possible damage to the card edge connector or connector pins inside the housing.

4.05 Insert the left Dial Tone Generator and the Control/Alarm circuit cards into the housing. Disregard the GEN ALARM. Do not install fuses at this time. Check to make sure the OUTPUT LEVEL potentiometer on each Dial Tone Generator card is set to mid-range. Set the ACO (alarm cut-off) switch to ON.

4.06 Install a one amp fuse in L and R and a one-half amp fuse in the C/A fuse holders. DISREGARD ALL ALARMS UNTIL THE OUTPUT LEVELS HAVE BEEN SET and the M-904 HAS BEEN EXERCISED.

4.07 Using the O/P TEST jacks on the Control/Alarm circuit card (Test Point 2 is common) to monitor the output

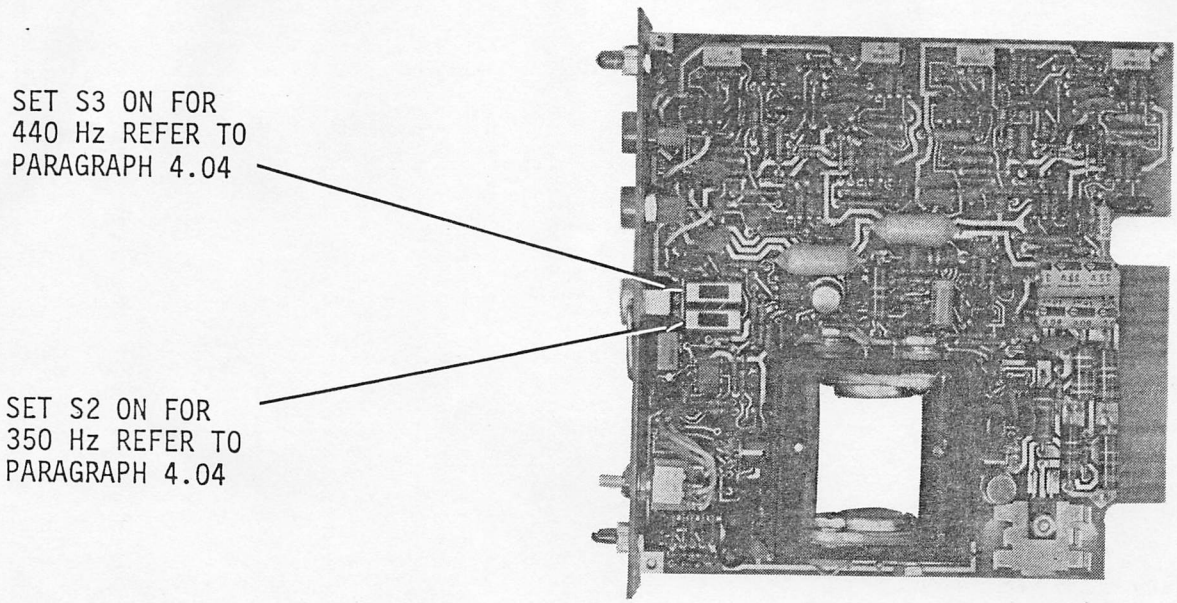


FIGURE 5 S2 AND S3 OPTION SWITCHES

SYMPTOM	POSSIBLE FAULT	CHECK OR REPLACE
LOW OR NO OUTPUT	1 INCORRECT WIRING 2 DIAL TONE GENERATOR CARD 3 BOTH DIAL TONE GENERATOR CARDS 4 INPUT POWER NOT CONNECTED	1 CHECK WIRING 2 DIAL TONE GENERATOR CARD 3 CONTROL/ALARM CARD 4 CHECK POWER CONNECTIONS
DIAL TONE SOURCE DOES NOT TRANSFER FROM LEFT DIAL TONE GENERATOR TO RIGHT DIAL TONE GENERATOR	1 CONTROL/ALARM CARD	1 CONTROL/ALARM CARD
UNABLE TO SET LEVEL DETECTOR	1 DIAL TONE GENERATOR CARD 2 CONTROL/ALARM CARD	1 DIAL TONE GENERATOR CARD 2 CONTROL/ALARM CARD
ALARM FAILS TO INDICATE CORRECT STATUS AT ALARM STATION	1 INCORRECT WIRING 2 DIAL TONE GENERATOR CARD 3 BOTH DIAL TONE GENERATOR CARDS	1 CHECK WIRING 2 DIAL TONE GENERATOR CARD 3 CONTROL/ALARM CARD

TABLE 4 TROUBLESHOOTING THE M-904

level, adjust the OUTPUT LEVEL potentiometer on the left Dial Tone Generator circuit card to obtain the reference measured previously.

4.08 Remove the left Dial Tone Generator circuit card. Insert the right Dial Tone Generator circuit card.

4.09 Using the O/P TEST jacks on the Control/Alarm circuit card (Test Point 2 is common) to monitor the output level, adjust the OUTPUT LEVEL potentiometer on the right Dial Tone Generator circuit card to obtain the reference measured previously.

4.10 Reinsert the left Dial Tone Generator circuit card. Both Dial Tone Generator circuit cards should now be inserted into the housing.

4.11 With the output levels of each Dial Tone Generator established, the level detectors can be set. On the left Dial Tone Generator card, depress the FAIL DETECT LEVEL button and at the same time adjust the FAIL DETECT LEVEL potentiometer until the FAIL DETECT LEVEL lamp extinguishes. Repeat this same step to adjust the FAIL DETECT LEVEL potentiometer on the right Dial Tone Generator circuit card.

4.12 Depress the GEN ALARM RESET button. Set the ACO switch to OFF. Both FAIL DETECT LEVEL lamps should now be extinguished.

4.13 Depress the FAIL L button. A minor alarm should be indicated at the office alarm station. Depress the GEN ALARM RESET button. Verify the alarm is now off. Depress the FAIL R button. A minor alarm should be indicated at the office alarm station. Depress the GEN ALARM RESET button. Verify the alarm is now off. Depress the FAIL L button. A minor alarm should be indicated at the office alarm station. Depress the FAIL R button. A major alarm should be indicated at the office alarm station. Depress the GEN ALARM RESET button. Verify all alarms are off.

4.14 Using a small metal screw driver with an insulated handle, insert the blade of the screw driver between the fuse spring and the alarm contact on the fuse holder to simulate a blown fuse. The FUSE FAIL lamp should light and the fuse fail alarm should be initiated. Check fuse holders L, R and C/A.

NOTE: Use a hook wire when pulling fuses to prevent damaging fuses.

4.15 Remove fuses L, R and C/A one at a time. When L fuse or R fuse is removed a minor alarm will be initiated. When the C/A fuse is removed, a major alarm will be initiated. Do not reinstall the fuses.

4.16 This completes the initial installation and exercise. Procede to cut over the M-904 Dial Tone Generator according to local practices. Install fuses L, R, and C/A and depress the GEN ALARM RESET button. Verify that the IN USE lamp on the left Dial Tone Generator card is lighted and that dial tone is present at the front panel output test jacks labeled OUTPUT MONITOR on each Dial Tone Generator card. Using a level (VRMS) meter, measure the output of the M-904 and verify that the output level is set to the reference. Adjust the OUTPUT LEVEL potentiometers as described for slight adjustments if necessary.

NOTE: The FAIL DETECT LEVEL lamps may light

If some adjustment is performed, recalibrate the level detectors as described.

4.17 Verify that the ACO switch is OFF, the left Dial Tone Generator IN USE lamp is lighted and that there are no alarms activated and that no FAIL DETECT LEVEL LAMPS are lighted.

4.18 Install the rear cover.

5. Troubleshooting the M-904

5.01 The troubleshooting guide, table 4, is intended to deal with either installation test problems, exercise failures, or with problems after the M-904 has been operating for some time. Typical symptoms can be

divided into four areas as described in table 4. This technique is intended to clear the problem by circuit card substitution and/or replacement. Associated with each symptom are possible faults and corresponding checks or card replacement information to clear the problem.

5.02 Once the faulty card has been located and removed from the housing, the card should be returned for repair. No attempt should be made to adjust or tamper with the circuit card components.

6. Maintenance

6.01 No routine maintenance is required. However, the M-904 should be periodically exercised for transfer and alarm functions according to locally established practices. The following brief maintenance exercise should be performed periodically. If the unit fails to operate as described, refer to Section 5, TROUBLESHOOTING THE M-904. The exercise will not interupt service provided both Dial Tone Generators are operating. A "click" will be heard during transfer.

(A) Maintenance exercise

1. Set the ACO (alarm cut-off) switch to ON. Observe that the ACO lamp lights.

2. Depress the FAIL L button. A MINOR ALARM (visual only) should be indicated at the office alarm station and on the M-904 panel.

3. Depress the GEN ALARM RESET button. Verify that the alarm is now off and the MINOR ALARM lamp is extinguished.

4. Depress the FAIL R button. A MINOR ALARM (visual only) should be indicated at the office alarm station and on the M-904 panel.

5. Depress the GEN ALARM RESET button. Verify that the alarm is now off and the MINOR ALARM lamp is extinguished.

6. Depress the FAIL L button and then depress the FAIL R button. A MAJOR ALARM and MINOR ALARM (visual only) should be indicated at the office alarm station and both ALARM lamps should light.

7. Depress the GEN ALARM RESET button. Verify all alarms are off.

8. Set the ACO switch to OFF.

7. Specifications

OUTPUT

Frequency:	350 and/or 440 Hz ± 0.5%
Harmonic Distortion	Single frequency - each harmonic is at least 50 dB down from its fundamental.
	Dual Tone - each Harmonic is down at least 45 dB from either fundamental.
Power Output:	Maximum one watt, voltage variable between 0.5 to 23 VRMS dual frequency, single frequency 0.35 to 16.0 VRMS

FAILURE DETECTION

Level:	Failure detection occurs, if the level varies outside a 3 ± 0.5 dB window as set by the user.
Frequency:	Failure detection occurs, if the frequency of any oscillator varies more than 1.5% minimum to 3% maximum
Time:	The time to detect a failure and transfer i about 220 milliseconds

POWER REQUIREMENTS

Voltage:	-45 to -56 VDC, with power supply reversal protection
Current:	500 milliamperes maximum
Fusing:	Standard Buss GMT, two 1 amp and one 1/2 amp fuses

CONNECTION

Rear Connector:	Wire wrap, protected by a rear cover

ENVIRONMENTAL

Temperature:	0° to 55° C

TELTONE®

Technical Practice

November 29, 1979 ADDENDUM to
M-904-100, Issue 3, July, 1977

M-904 Precise Dial Tone Generator

addendum

August 19, 1978 changes

PAGE 8, Section 7, SPECIFICATIONS,
OUTPUT, Harmonic Distortion:
should read

Harmonic Distortion:	Single frequency–each harmonic is at least 45 dB down from its fundamental.

November 29, 1979 changes

Page 5, add the following note to Paragraph 4.07:

Note: When measuring voltage level at "O/P Test" jacks, eliminate loading and possible false reading by using an unterminated high impedance meter of 1 megohm or more. An optional method using a low impedance meter inserts a 1 megohm resistor in series with one or both meter leads.

This addendum is an expediency to assure that the most current information is available to the practice user pending publication of a new issue of the practice. It is suggested that the user either mark up the practice per these corrections and/or additions or that indications be made at each point referenced that there is a change to it. This ought to be done upon first receiving the addendum.

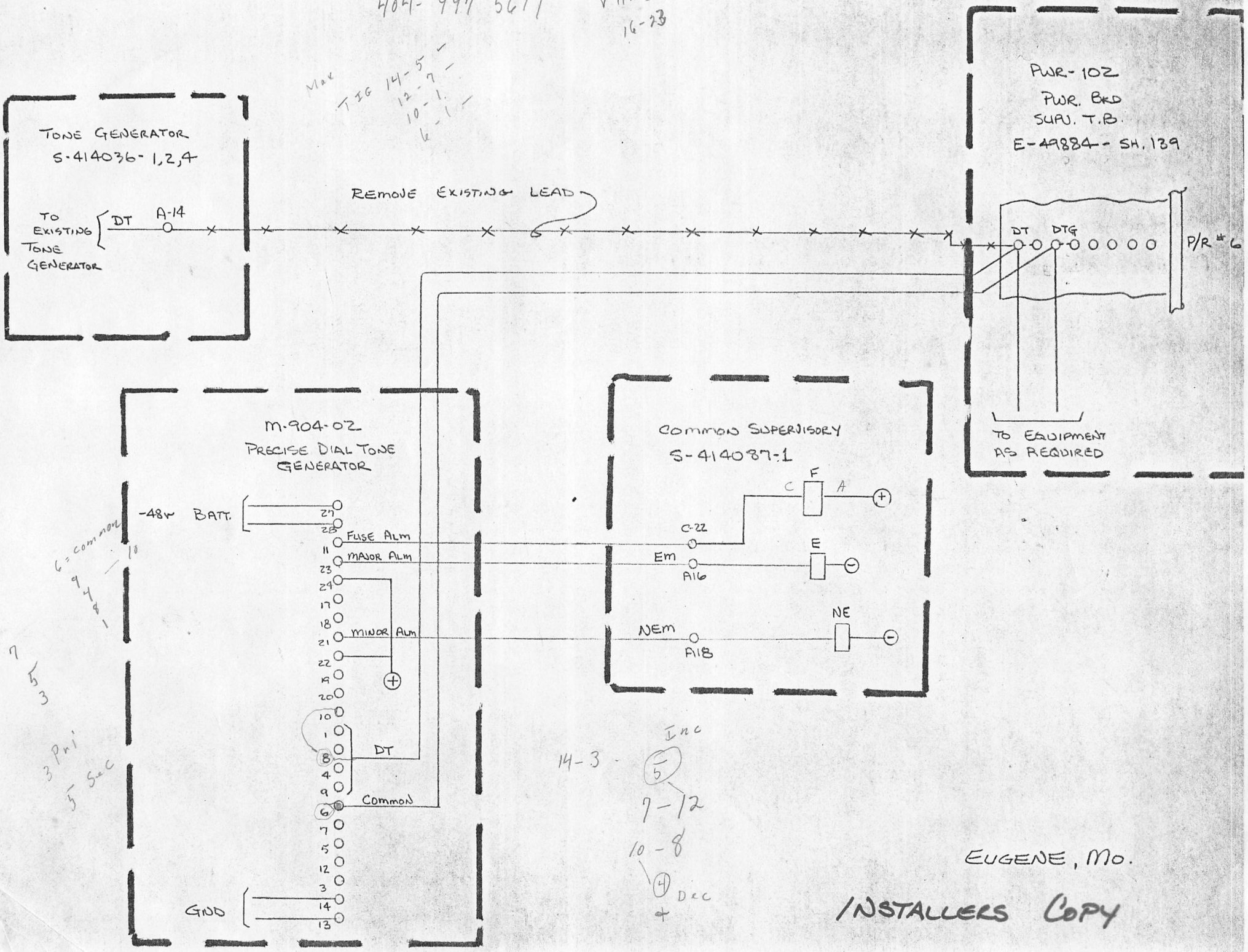
TELTONE is a registered trademark of TELTONE CORPORATION
Copyright © 1979, by TELTONE CORPORATION

Printed in U.S.A.

404-997 5617

VRMS
16-23

Max
TIG 14-5
12-7
10-1
6-1



EUGENE, MO.

INSTALLERS COPY